PATENT ABSTRACTS OF JAPAN

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(54) SOLID HIGH POLYMER ELECTROLYTE FUEL CELL

(57)Abstract:

PURPOSE: To enable cell reaction to be stably kept on by facilitating exhaust of generated water and moving water at the side of a cathodeand also facilitating dispersion of oxygen gas within oxidant.

CONSTITUTION: The cell is equipped with a laminated body 31 where an anode 33 and a cathode 34 are provided for both the surfaces of an electrolyte 32 respectivelya fuel distributing plate 37 which is provided for the anode 33 side of the aforesaid laminated body 31 while being provided with a fuel flow path 36 feeding fuel to the anode 33and with an oxidant distributing plate 40 which is provided for the cathode side of the aforesaid laminated body 31 while being provided with an oxidant flow path 39 feeding oxidant to the aforesaid cathode 34. And at least either of the depth or the width of the oxidant flow path 39 of the aforesaid oxidant distributing plate 40 is made gradually small along the flow path area of oxidant from the upstream area to the downstream area.

CLAIMS

[Claim(s)]

[Claim 1]A solid polymer electrolyte fuel cell which possesses an oxidizer separator and is characterized by a thing of the depth of an oxidizer passage of said oxidizer separatoror width for which either was gradually made small along a downstream channel region from an upper channel region of an oxidizer at leastcomprising:

A layered product which has arranged an anode pole and a cathode pole to the electrolytic both-sides siderespectively.

A fuel separator with a fuel passage which is established in the anode pole side of said layered productand supplies fuel to said anode pole.

An oxidizer passage which is established in the cathode pole side of said layered productand supplies an oxidizer to said cathode pole.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the solid polymer electrolyte fuel cell which improved to the oxidizer passage of the oxidizer separator.

[0002]

[Description of the Prior Art]As shown in drawing 3a solid polymer electrolyte fuel cell uses a polymer ion-exchange membrane (for examplefluoro-resin system ion-exchange membrane with a sulfonic group) for the electrolyte 1and is having electrode conjugate 6 structure which equipped both sides with the catalyzer electrode layers (for exampleplatinum) 2 and 3 and the porous carbon electrodes

4 and 5. Hydrogen in the humidification fuel supplied to the anode pole side is hydrogen-ion-ized on the catalyzer electrode (anode pole) 2and a hydrogen ion moves the inside of the electrolyte 1 to the cathode pole side with water as H^+andxH_2O also as the intervention of water.

[0003]The hydrogen ion which moved will react to the electron which has circulated oxygen and the external circuit 7 in an oxidizer on the catalyzer electrode (cathode terminal) 3and will generate waterand the produced water will be discharged out of a fuel cell from the cathode pole 3. At this timethe electronic flow which circulated the external circuit 7 can be used as electrical energy of a direct current. In the polymer ion-exchange membrane used as the electrolyte 1in order to realize the above hydrogen ion permeabilityIt is necessary to hold this film in the water retention state which always becomes enoughand saturated steam of the operating-temperature neighborhood of a cell is usually included in fuel or an oxidizernamelyit humidifiesand he supplies fuel and an oxidizer to the electrode conjugate 6and is trying to maintain a membranous water retention state. Belowthe reaction formula in the above-mentioned solid polymer electrolyte fuel cell is shown.

anode side: -- H_2 -->$2H^+$+2e- cathode side: (1/2) -- O_2+$2H^+$+2e-->H_2O overall reaction: -- H -- 2+(1/2) O_2->H_2O drawing 2 (A). (B) and (C) show an example of the composition of the conventional solid polymer electrolyte fuel cell.

[0004]11 in a figure is the layered product which laminated the 1st catalyzer electrode (anode pole) 13 and the 2nd catalyzer electrode (cathode pole) 14 to the upper and lower sides of the electrolyte 12. The fuel separator 17 with the fuel passage 16 is formed in this layered product 11 upper part via the 1st porosity carbon electrodes (anode pole) 15. The oxidizer separator 20 with the oxidizer passage 19 is formed in said layered product 11 bottom via the 2nd porosity carbon electrodes (cathode terminal) 18respectively. Herein the oxidizer passage 19a channel depth also has a fixed cross-section area by regularity (d_1=d_2) uniformly [a flute width]. As for $d_1$the tooth depth of an oxidizer entrance side and d_2 show the depth by the side of an oxidizing agent outlet.

[0005]In the fuel cell of this compositionthe fuel hydrogen which has flowed through the fuel passage 16 passes the 1st carbon electrodes 15and is hydrogen-ion-ized on the 1st catalyzer electrode 13and a hydrogen ion moves the inside of the electrolyte 12 to the cathode pole side with water as basis H^+andxH_2O of an intervention of water. The water generated by this hydrogen ion on the 2nd catalyzer electrode 14and the water which has moved from the anode pole side with the hydrogen ion in the inside of the electrolyte 12 A steam. Or with a liquida part passes the 2nd carbon electrodes 18 and is discharged in the oxidizer which flows through the oxidizer passage 19 where a cross-section area is constant toward a downstream channel region from an upper channel region.

[0006]

[Problem to be solved by the invention]As shown in drawing 2toward a downstream channel region from an upper channel region Howeverthe passage groove width regularityAnd in a solid polymer electrolyte fuel cell with the oxidizer separator 20 with the channel where the cross-section area of channel depth regularity (d_1=d_2) is uniformFrom the produced water by which it is generated in connection with a cell reactionand the move water which has moved to the cathode terminal from the anode electrode with the hydrogen ionsince the steam partial pressure in the oxidizer atmosphere rises so that it goes to the downstream area of the oxidizer passage 19it becomes a steam and gas diffusion discharge becomes is hard to be carried out. Thereforeliquid[partial]-izingand produced water and move water which were droplet-ized of the steam were got blocked into the 2nd porosity cathode pole side carbon electrodes 18and it had become the structure which falls into the situation where the gas diffusion of the oxidizer in the inside of the 2nd porosity carbon electrodes 18 is easy to be preventedeasily.

[0007]This invention was made in consideration of such a situationand by [of the depth of the oxidizer passage of an oxidizer separator or width] making either small gradually along a downstream channel region from the upper channel region of an oxidizer at leastThe gas diffusion discharge of produced water and

move water in which the rate of flow in the downstream channel region of an oxidizer passage became a steam early is easy to be carried outOr while being able to blow away in part liquid-izingthe produced water which droplet-izes and exists in porosity carbon electrodesand move waterhaving and discharge of the produced water by the side of a cathode pole or move water becoming goodThe gas diffusion of oxygen in an oxidizer is also aimed at providing the solid polymer electrolyte fuel cell which becomes good and can be performed by continuing the stable cell reaction.

[0008]

[Means for solving problem]The solid polymer electrolyte fuel cell this invention is characterized by that comprises the following and which possesses an oxidizer separator and is characterized by the thing of the depth of the oxidizer passage of said oxidizer separatoror width for which either was gradually made small along the downstream channel region from the upper channel region of the oxidizer at least.

The layered product which has arranged the anode pole and the cathode pole to the electrolytic both-sides siderespectively.

A fuel separator with the fuel passage which is established in the anode pole side of said layered productand supplies fuel to said anode pole.

The oxidizer passage which is established in the cathode pole side of said layered productand supplies an oxidizer to said cathode pole.

[0009]

[Function]By making small the cross-section area of the oxidizer passage of an oxidizer separator to which an oxidizer is supplied toward a downstream channel region in a solid polymer electrolyte fuel cell from an upper channel regionEven if the steam partial pressure in oxidizer atmosphere rises earlythe rate of flow in the downstream channel region of an oxidizerThe gas diffusion discharge of produced water and move water used as a steam can be easy to be carried outor liquid-izingthe produced water which droplet-izes and exists in porosity carbon

electrodesand move water can be blown away now in part by the early oxidant gas rate of flow. By these Sayodischarge of the produced water by the side of a cell cathode pole or move water becomes goodand becomes still better [the gas diffusion of oxygen in an oxidizer]and the stable cell reaction can be maintained.

[0010]

[Working example]Hereafterone working example of this invention is described with reference to drawing 1 (A)(B)and (C). Heredrawing 1 (A) shows the front view of a solid polymer electrolyte fuel cellthe side view of the fuel cell which drawing 1 (B) looked at from the oxidizer entrance sideand the side view of the fuel cell which drawing 1 (C) looked at from the oxidizing agent outlet.

[0011]31 in a figure is the layered product which laminated the 1st catalyzer electrode (anode pole) 33 and the 2nd catalyzer electrode (cathode pole) 34 to the upper and lower sides of the electrolyte 32. The fuel separator 37 with the fuel passage 36 is formed in this layered product 31 upper part via the 1st porosity carbon electrodes (anode pole) 35. The oxidizer separator 40 with the oxidizer passage 39 is formed in said layered product 31 bottom via the 2nd porosity carbon electrodes (cathode terminal) 38respectively. Herethe depth which is the oxidizer passage 39 becomes [an oxidizer entrance side] $d_1 > d_2$ by depth d_2 by depth d_1 at the oxidizing agent outlet sideand is becoming small gradually along with an oxidizer entrance side to the oxidizing agent outlet side.

[0012]In the fuel cell of such compositionthe fuel hydrogen which has flowed through the fuel passage 36 passes the 1st carbon electrodes 35and is hydrogen-ion-ized on the 1st catalyzer electrode 33and a hydrogen ion moves the inside of the electrolyte 32 to the cathode pole side with water as basis H^+andxH_2O of an intervention of water. The water generated by this hydrogen ion on the 2nd catalyzer electrode 34and the water which has moved from the anode pole side with the hydrogen ion in the inside of the electrolyte 32Even if the steam partial pressure in oxidizer atmosphere is highwith a liquida steam or a part passes the 2nd carbon electrodes 38and is discharged by the early gas flow rate of an oxidizer in the oxidizer which flows all over the oxidizer passage 39.

[0013]Since the depth of the oxidizer passage 39 has structure which becomes small gradually along with the oxidizing agent outlet side (depth d_2) from an oxidizer entrance side (depth d_1) according to above-mentioned working examplea cross-section area of the oxidizer passage 39 becomes small toward an upper channel region to a downstream channel region. Thereforewith produced water and move water which were discharged in an upper channel region of the oxidizer passage 39although a steam partial pressure in the oxidizer atmosphere rises in a downstream channel region of the oxidizer passage 39The gas diffusion discharge of produced water and move water in which the rate of flow in a downstream channel region of an oxidizer became quickand became a steam can be easy to be carried outor liquid-izingproduced water which droplet-izes and exists in porosity carbon electrodesand move water can be blown away now in part by the quick oxidant gas rate of flow. It is possible for discharge of produced water by the side of a cathode pole of a cell or move water to become goodand to become still better [gas diffusion of oxygen in an oxidizer]and to perform a stable cell reaction continuously by these Sayo.

[0014]Although above-mentioned working example described a case where the depth of an oxidizer passage was made composition which becomes small gradually along with the oxidizing agent outlet side from an oxidizer entrance sideWidth of an oxidizer passage may be gradually made small along with the oxidizing agent outlet side from an oxidizer entrance sidefor exampleor it may have not only this but composition which makes the depth and width of an oxidizer passage small gradually along with the oxidizing agent outlet side from an oxidizer entrance side simultaneously.

[0015]

[Effect of the Invention]As explained in full detail aboveeven if there is little depth of the oxidizer passage of an oxidizer separator or widthin this inventioneither is gradually made small along a downstream channel region from the upper channel region of an oxidizer.

Thereforethe gas diffusion discharge of produced water and move water in which

the rate of flow in the downstream channel region of an oxidizer passage became a steam early is easy to be carried outOr while being able to blow away in part liquid-izingthe produced water which droplet-izes and exists in porosity carbon electrodesand move waterhaving and discharge of the produced water by the side of a cathode pole or move water becoming goodThe solid polymer electrolyte fuel cell which becomes good [the gas diffusion of oxygen in an oxidizer]and can be performed by continuing the stable cell reaction can be provided.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is an explanatory view of the solid polymer electrolyte fuel cell concerning one working example of this inventionand drawing 1 (A) shows a front viewthe side view which drawing 1 (B) looked at from the oxidizer entrance sideand the side view which drawing 1 (C) looked at from the oxidizing agent outlet.

[Drawing 2]It is an explanatory view of the conventional solid polymer electrolyte fuel celland drawing 2 (A) shows a front viewthe side view which drawing 2 (B) looked at from the oxidizer entrance sideand the side view which drawing 2 (C) looked at from the oxidizing agent outlet.

[Drawing 3]The figure for explaining the function of a solid polymer electrolyte fuel cell.

[Explanations of letters or numerals]

31 [-- The 2nd catalyzer electrode and 35 / -- The 1st carbon electrodes and 36 / -- A fuel passage37 / -- A fuel separator and 38 / -- The 2nd carbon electrodes and 39 / -- An oxidizer passage40 / -- Oxidizer separator.] -- A layered product

and 32 -- An electrolyte and 33 -- The 1st catalyzer electrode34